WHAT IS CLAIMED IS:

1. An ultrasonic flow detection apparatus, comprising:

a first transducer to transmit a signal;

a second transducer to receive the signal;

at least one end cap separating the first transducer and the second transducer from a fluid, the end cap having a reflective surface located in contact with the fluid; and

a curved reflecting surface to reflect the signal to the reflective surface.

2. The ultrasonic flow detection apparatus according to claim 1, wherein the signal transmitted by the first transducer reflects off of the reflective surface.

3. The ultrasonic flow detection apparatus according to claim 2, wherein the signal transmitted by the first transducer reflects off of the reflective surface of the end cap back to the curved reflecting surface.

4. The ultrasonic flow detection apparatus according to claim 1, wherein the signal transmitted by the first transducer approximately traverses a W shaped path that extends from the first transducer to the curved reflecting surface to the reflective surface to the curved reflecting surface to the second transducer.

5. The ultrasonic flow detection apparatus according to claim 1, wherein a distance between the reflective surface and a point located between the first transducer and the second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the transmitted signal, and n is an integer.

6. The ultrasonic flow detection apparatus according to claim 1, wherein a distance between a first transducer surface or a second transducer surface and an end cap surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the transmitted signal, and n is an integer.

7. The ultrasonic flow detection apparatus according to claim 1, wherein the signal travels generally in the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

8. The ultrasonic flow detection apparatus according to claim 1, wherein the signal travels generally in a direction opposite the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

9. An ultrasonic flow detection apparatus, comprising:

a first transducer to transmit a signal;

a second transducer to receive the signal; and

a curved reflecting surface to reflect the signal toward a reflective surface, wherein the reflective surface lies along an axis approximately half-way between the first transducer and the second transducer, a path of the signal extends generally along a longitudinal axis of a duct parallel to a direction of fluid flow, the path extends from the first transducer to the curved reflecting surface to the reflective surface to the curved reflecting surface to the second transducer.

10. The ultrasonic flow detection apparatus according to claim 9, further including at least one end cap to separate the first transducer and the second transducer from a fluid.

11. The ultrasonic flow detection apparatus according to claim 9, wherein a distance between the reflective surface and a point located between the first transducer and the second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

12. The ultrasonic flow detection apparatus according to claim 10, wherein a distance between a first transducer surface or a second transducer surface and an end cap surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

13. The ultrasonic flow detection apparatus according to claim 9, wherein the curved reflecting surface is located on a duct wall.

14. The ultrasonic flow detection apparatus according to claim 9, wherein the signal travels generally in the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

15. The ultrasonic flow detection apparatus according to claim 9, wherein the signal travels generally in a direction opposite the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

16. An ultrasonic sensor system, comprising:

a duct;

a fluid flowing through the duct in a flow direction;

an ultrasonic flow sensor sealingly coupled to the duct, including:

a first transducer to transmit a signal,

a second transducer to receive the signal,

at least one end cap to separate the first transducer and the second transducer from the fluid; and

a curved reflecting surface to reflect the signal toward a reflective surface located on the end cap, wherein the reflective surface lies along an axis approximately half-way between the first transducer and the second transducer, a path of the signal extends generally along a longitudinal axis of the duct parallel to the flow direction, the path extends from the first transducer to the curved reflecting surface to the reflective surface to the curved reflecting surface to the second transducer.

17. The ultrasonic sensor system according to claim 16, wherein the curved reflecting surface is located on a duct wall.

18. The ultrasonic sensor system according to claim 16, wherein the signal travels generally in the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

19. The ultrasonic sensor system according to claim 16, wherein the signal travels generally in a direction opposite the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

20. The ultrasonic sensor system according to claim 16, wherein a distance between the reflective surface and a point located between the first transducer and the second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

21. The ultrasonic sensor system according to claim 16, wherein a distance between a first transducer surface or a second transducer surface and an end cap surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

22. An ultrasonic sensor system, comprising:

a duct;

a fluid flowing through the duct in a flow direction;

an ultrasonic flow sensor sealingly coupled to the duct, including:

a first transducer to transmit a signal,

a second transducer to receive the signal, and

a curved reflecting surface to reflect the signal toward a reflective surface, wherein the reflective surface lies along an axis approximately half-way between the first transducer and the second transducer, a path of the signal extends generally along a longitudinal axis of the duct parallel to the flow direction, the path extends from the first transducer to the curved reflecting surface to the reflective surface to the curved reflecting surface to the second transducer.

23. The ultrasonic sensor system according to claim 22, further including at least one end cap to separate the first transducer and the second transducer from the fluid.

24. The ultrasonic sensor system according to claim 22, wherein the curved reflecting surface is located on a duct wall.

25. The ultrasonic sensor system according to claim 22, wherein a distance between the reflective surface and a point located between the first transducer and the second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

26. The ultrasonic sensor system according to claim 22, wherein a distance between a first transducer surface or a second transducer surface and an end cap surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

27. The ultrasonic sensor system according to claim 22, wherein the signal travels generally in the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

28. The ultrasonic sensor system according to claim 22, wherein the signal travels generally in a direction opposite the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

29. A method of determining a flow rate of a fluid in a duct, comprising:

transmitting a signal through an end cap and a fluid, wherein a path of the signal extends generally along a longitudinal axis of a duct parallel to a direction of fluid flow, and the end cap acts as a barrier to the fluid;

reflecting the signal from a curved reflecting surface;

receiving the signal;

measuring a first time between transmitting the signal in a forward direction and receiving the signal;

measuring a second time between transmitting the signal in a reverse direction and receiving the signal; and

comparing the first time to the second time to determine a flow rate of the fluid.

30. The method according to claim 29, wherein the curved reflecting surface is located on a wall of the duct.

31. The method according to claim 29, wherein the path of the signal extends from an originating point to the curved reflecting surface to a reflective surface to the curved reflecting surface to a destination point, and the reflective surface lies along an axis approximately half-way between the originating point and the destination point.

32. The method according to claim 31, wherein a distance between the reflective surface and a point located between the originating point and the destination point is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

33. The method according to claim 32, wherein a distance between the originating point or the destination point and an end cap surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

34. The method according to claim 29, wherein the signal travels generally in the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

35. The method according to claim 29, wherein the signal travels generally in a direction opposite the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

36. A method of determining a flow rate of a fluid in a duct, comprising:

transmitting a signal through a fluid from an originating point;

reflecting the signal from a curved reflecting surface to a reflective surface to the curved reflecting surface to a destination point, wherein the reflective surface lies along an axis approximately half-way between the originating point and the destination point;

receiving the signal at the destination point;

measuring a first time between transmitting the signal in a forward direction and receiving the signal;

measuring a second time between transmitting the signal in a reverse direction and receiving the signal; and

comparing the first time to the second time to determine a flow rate of the fluid.

37. The method according to claim 36, wherein at least one end cap separates a first transducer and a second transducer from the fluid.

38. The method according to claim 37, wherein a distance between the reflective surface and a point located between the first transducer and the second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

39. The method according to claim 36, wherein a distance between a first transducer surface or a second transducer surface and an end cap surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

40. The method according to claim 36, wherein the curved reflecting surface is located on a wall of the duct.

41. The method according to claim 36, wherein the signal travels generally in a direction of fluid flow and the signal is used to measure a rate of the fluid flow.

42. The method according to claim 36, wherein the signal travels generally in a direction opposite a direction of fluid flow and the signal is used to measure a rate of the fluid flow.

43. A method of installing an ultrasonic sensor into an existing duct assembly, comprising:

removing an existing fluid sensor from an existing duct assembly;

mounting a retrofit assembly including a boot structure with a mounting flange to the duct assembly;

machining a curved reflecting surface;

removing contamination from the boot structure; and

installing an ultrasonic sensor.

44. An ultrasonic flow detection apparatus, comprising:

a first transducer to transmit a signal;

a second transducer to receive the signal;

at least one end cap separating the first transducer and the second transducer from a fluid, the end cap having a reflective surface located in contact with the fluid; and

a parabolic reflecting surface to reflect the signal to the reflective surface.

45. The ultrasonic flow detection apparatus according to claim 44, wherein the signal transmitted by the first transducer reflects off of the reflective surface.

46. The ultrasonic flow detection apparatus according to claim 45, wherein the signal transmitted by the first transducer reflects off of the reflective surface of the end cap back to the parabolic reflecting surface.

47. The ultrasonic flow detection apparatus according to claim 44, wherein the signal transmitted by the first transducer approximately traverses a W shaped path that extends from the first transducer to the parabolic reflecting surface to the reflective surface to the parabolic reflecting surface to the second transducer.

48. The ultrasonic flow detection apparatus according to claim 44, wherein a distance between the reflective surface and a point located between the first transducer and the second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the transmitted signal, and n is an integer.

49. The ultrasonic flow detection apparatus according to claim 44, wherein a distance between a first transducer surface or a second transducer surface and an end cap surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the transmitted signal, and n is an integer.

50. The ultrasonic flow detection apparatus according to claim 44, wherein the signal travels generally in the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

51. The ultrasonic flow detection apparatus according to claim 44, wherein the signal travels generally in a direction opposite the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

52. The ultrasonic flow detection apparatus according to claim 44, wherein a distance between the reflective surface and a point located between the first transducer and the second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the transmitted signal, and n is an integer.

53. The ultrasonic flow detection apparatus according to claim 44, wherein a distance between a first transducer surface or a second transducer surface and an end cap surface is approximately equal to $(n/4)\lambda$, where λ is a wavelength of the transmitted signal, and n is an integer.

54. The ultrasonic flow detection apparatus according to claim 44, wherein the end cap is made of a material selected from the group consisting of a metal, an alloy, and a plastic.

55. An ultrasonic flow detection apparatus, comprising:

a first transducer to transmit a signal;

a second transducer to receive the signal; and

a parabolic reflecting surface to reflect the signal toward a reflective surface, wherein the reflective surface lies along an axis approximately half-way between the first transducer and the second transducer, a path of the signal extends generally along a longitudinal axis of a duct parallel to a direction of fluid flow, the path extends from the first transducer to the parabolic reflecting surface to the reflective surface to the parabolic reflecting surface to the second transducer.

56. The ultrasonic flow detection apparatus according to claim 55, further including at least one end cap to separate the first transducer and the second transducer from a fluid.

57. The ultrasonic flow detection apparatus according to claim 55, wherein a distance between the reflective surface and a point located between the first transducer and the second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

58. The ultrasonic flow detection apparatus according to claim 55, wherein a distance between a first transducer surface or a second transducer surface and the reflective surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

59. The ultrasonic flow detection apparatus according to claim 55, wherein the parabolic reflecting surface is located on a duct wall.

60. The ultrasonic flow detection apparatus according to claim 55, wherein the signal travels generally in the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

61. The ultrasonic flow detection apparatus according to claim 55, wherein the signal travels generally in a direction opposite the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

62. The ultrasonic flow detection apparatus according to claim 55, wherein a distance between a first transducer surface or a second transducer surface and the reflective surface is approximately equal to $(n/4)\lambda$, where λ is a wavelength of the transmitted signal, and n is an integer.

63. The ultrasonic flow detection apparatus according to claim 56, wherein the end cap is made of a material selected from the group consisting of a metal, an alloy, and a plastic.

64. An ultrasonic sensor system, comprising:

a duct;

a fluid flowing through the duct in a flow direction;

an ultrasonic flow sensor sealingly coupled to the duct, including:

a first transducer to transmit a signal,

a second transducer to receive the signal,

at least one end cap to separate the first transducer and the second transducer from the fluid; and

a parabolic reflecting surface to reflect the signal toward a reflective surface located on the end cap, wherein the reflective surface lies along an axis approximately half-way between the first transducer and the second transducer, a path of the signal extends generally along a longitudinal axis of the duct parallel to the flow direction, the path extends from the first transducer to the parabolic reflecting surface to the reflective surface to the parabolic reflecting surface to the second transducer.

65. The ultrasonic sensor system according to claim 64, wherein the parabolic reflecting surface is located on a duct wall.

66. The ultrasonic sensor system according to claim 64, wherein the signal travels generally in the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

67. The ultrasonic sensor system according to claim 64, wherein the signal travels generally in a direction opposite the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

68. The ultrasonic sensor system according to claim 64, wherein a distance between the reflective surface and a point located between the first transducer and the second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

69. The ultrasonic sensor system according to claim 64, wherein a distance between a first transducer surface or a second transducer surface and an end cap surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

70. The ultrasonic sensor system according to claim 64, wherein a distance between a first transducer surface or a second transducer surface and an end cap surface is approximately equal to (n/4)λ, where λ is a wavelength of the signal, and n is an integer.

71. The ultrasonic sensor system according to claim 64, wherein the end cap is made of a material selected from the group consisting of a metal, an alloy, and a plastic.

72. An ultrasonic sensor system, comprising:

a duct;

a fluid flowing through the duct in a flow direction;

an ultrasonic flow sensor sealingly coupled to the duct, including:

a first transducer to transmit a signal,

a second transducer to receive the signal, and

a parabolic reflecting surface to reflect the signal toward a reflective surface, wherein the reflective surface lies along an axis approximately half-way between the first transducer and the second transducer, a path of the signal extends generally along a longitudinal axis of the duct parallel to the flow direction, the path extends from the first transducer to the parabolic reflecting surface to the reflective surface to the parabolic reflecting surface to the second transducer.

73. The ultrasonic sensor system according to claim 72, further including at least one end cap to separate the first transducer and the second transducer from the fluid.

74. The ultrasonic sensor system according to claim 72, wherein the parabolic reflecting surface is located on a duct wall.

75. The ultrasonic sensor system according to claim 72, wherein a distance between the reflective surface and a point located between the first transducer and the second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

76. The ultrasonic sensor system according to claim 72, wherein a distance between a first transducer surface or a second transducer surface and the reflective surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

77. The ultrasonic sensor system according to claim 72, wherein the signal travels generally in the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

78. The ultrasonic sensor system according to claim 72, wherein the signal travels generally in a direction opposite the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

79. The ultrasonic sensor system according to claim 72, wherein a distance between a first transducer surface or a second transducer surface and the reflective surface is approximately equal to $(n/4)\lambda$, where λ is a wavelength of the signal, and n is an integer.

80. The ultrasonic sensor system according to claim 73, wherein the end cap is made of a material selected from the group consisting of a metal, an alloy, and a plastic.

81. A method of determining a flow rate of a fluid in a duct, comprising:

transmitting a signal through an end cap and a fluid, wherein a path of the signal extends generally along a longitudinal axis of a duct parallel to a direction of fluid flow, and the end cap acts as a barrier to the fluid;

reflecting the signal from a parabolic reflecting surface;

receiving the signal;

measuring a first time between transmitting the signal in a forward direction and receiving the signal;

measuring a second time between transmitting the signal in a reverse direction and receiving the signal; and

comparing the first time to the second time to determine a flow rate of the fluid.

82. The method according to claim 81, wherein the parabolic reflecting surface is located on a wall of the duct.

83. The method according to claim 81, wherein the path of the signal extends from an originating point to the parabolic reflecting surface to a reflective surface to the parabolic reflecting surface to a destination point, and the reflective surface lies along an axis approximately half-way between the originating point and the destination point.

84. The method according to claim 83, wherein a distance between the reflective surface and a point located between the originating point and the destination point is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

85. The method according to claim 84, wherein a distance between the originating point or the destination point and an end cap surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

86. The method according to claim 81, wherein the signal travels generally in the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

87. The method according to claim 81, wherein the signal travels generally in a direction opposite the direction of the fluid flow and the signal is used to measure a rate of the fluid flow.

88. The method according to claim 84, wherein a distance between the originating point or the destination point and an end cap surface is approximately equal to $(n/4)\lambda$, where λ is a wavelength of the signal, and n is an integer.

89. The method according to claim 81, wherein the end cap is made of a material selected from the group consisting of a metal, an alloy, and a plastic.

90. A method of determining a flow rate of a fluid in a duct, comprising:

transmitting a signal through a fluid from an originating point;

reflecting the signal from a parabolic reflecting surface to a reflective surface to the parabolic reflecting surface to a destination point, wherein the reflective surface lies along an axis approximately half-way between the originating point and the destination point;

receiving the signal at the destination point;

measuring a first time between transmitting the signal in a forward direction and receiving the signal;

measuring a second time between transmitting the signal in a reverse direction and receiving the signal; and

comparing the first time to the second time to determine a flow rate of the fluid.

91. The method according to claim 90, wherein at least one end cap separates a first transducer and a second transducer from the fluid.

92. The method according to claim 90, wherein a distance between the reflective surface and a point located between a first transducer and a second transducer is approximately equal to $(3/4 + n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

93. The method according to claim 90, wherein a distance between a first transducer surface or a second transducer surface and the reflective surface is approximately equal to $(n/2)\lambda$, where λ is a wavelength of the signal, and n is an integer.

94. The method according to claim 90, wherein the parabolic reflecting surface is located on a wall of the duct.

95. The method according to claim 90, wherein the signal travels generally in a direction of fluid flow and the signal is used to measure a rate of the fluid flow.

96. The method according to claim 90, wherein the signal travels generally in a direction opposite a direction of fluid flow and the signal is used to measure a rate of the fluid flow.

97. The method according to claim 90, wherein a distance between the originating point or the destination point and the reflective surface is approximately equal to $(n/4)\lambda$, where λ is a wavelength of the signal, and n is an integer.

98. The method according to claim 91, wherein the end cap is made of a material selected from the group consisting of a metal, an alloy, and a plastic.